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A
DESCRIPTION
OF A
Machine or Invention
To Work MILLS,

By the Power of a FIRE-ENGINE,
But particularly uſeful and profitable in
Grinding SUGAR CANES,

As it will Grind more than a Wind-Mill, and a Cattle Mill uſually do, without any Expence of Fuel, more than is conſumed in boiling the Sugars. By which it appears, there may be ſaved upwards of £600 Yearly, in every Eſtate which employs Eight or Ten Coppers; beſide many other Advantages.

And in New Eſtates may be ſaved from £1200. to £1500, in the firſt Expence of Building the Mills, and purchaſing the Cattle, &c. Beſide many other Advantages.

Which ENGINE, MACHINE, and SUGAR-MILL, may be ſet up to Work in Twelve or Fifteen Days Time.

TO WHICH IS ANNEXED
A Plan of a Fire Engine, the ſaid Machine, and a Sugar Mill and a Boiling Houſe.

With an APPENDIX.
Which ſhews, in a few PAGES,

The Utility of the ſaid Invention, and Anſwers and Explains every Objection or Doubt of it anſwering the Deſign which the Writer has heard of.

Alſo a calculation of the Power of Cattle in Grinding Canes, and the Power of FIRE ENGINES in the ſame, with References to the ſaid Deſcription.

By the King's Patent to JOHN STEWART.

1767

COMMISSIONERS OF PATENTS FOR INVENTIONS

18 70 APR

A Deſcription of a Machine or Invention to Grind Sugar-Canes:

By the Power of a Fire-Engine; ſuch as are uſed in raiſing Water out of Mines, &c.

IT is a Fact generally known, that Fire-Engines have been in uſe upwards of Fifty Years, and are proved to be the beſt Power to work Pumps, to raiſe Water out of the deepeſt Mines, where the greateſt Force is required; and is found to anſwer that Purpoſe, where all other Powers have failed. But on account of the alternate Motion of them, and ſome other Difficulties attending them; it was not diſcovered to be Practicable, to apply them to the circular Motion of Wheels, to work Mills, although many have attempted it, but without Succeſs; particularly Mr. John Wiſe, who at great Expence, erected a Fire-Engine, at or near Briſtol, for that Purpoſe, and made ſome kind of a Machine to be worked by it, for which he obtained the King's Patent, in the Year 1740. But it appears by his deſcription of it in the ſaid Patent, that the Conſtruction of it was on miſtaken Principles; the Force being apply'd by a perpendicular ſtroke from the Engine, to be aſſiſted by a Wheel, to be turned by a ſmall quantity of Water, to keep it in Motion, until the return of the alternate Motion of the Engine to give it the next ſtroke, and ſo on; and therefore could not be of uſe where any conſiderable Force (which was conſtant) was required. And although he added heavy Flyers to help to keep it in Motion, yet after being uſed ſome ſhort Time, in ſome light Work, it was found ſo uncertain, and difficult to manage, that it was entirely laid aſide; and on the fulleſt Enquiry which the Writer hath been able to make, he cannot find that any other Machine of the kind has been brought to Perfection; ſo far, as to be uſeful in any kind of Work ſince.

THE Writer is informed alſo, that ſeveral Years ago, ſome Perſon in Antiguo, laid a plan of a Machine to Grind Sugar Canes, by the power of a Fire Engine, before the Aſſembly of the ſaid Iſland; and petitioned for Money to enable him to erect a Fire Engine and ſaid Machine to prove it. But it is preſumed, that his Invention was on miſtaken Principles alſo; otherwiſe, the Gentlemen of the ſaid Aſſembly ("many of whom, and their Engineers "and Managers, may be ſuppoſed to be very capa"ble of judging of the Principles of it, and proba"bility of it ſucceeding") would have encouraged an Invention, which promiſed ſo great Benefit to the Iſland, had it appeared to them to be practicable, to bring it into Practice. But it was judged not practicable, and his Petition was rejected, and no Machine of the kind has been in uſe in the ſaid Iſland.

AND Mr. William Blakey obtained a Patent, in May or June laſt, for a new Invention of a Fire Engine, and ſeveral Machines, to raiſe Water, and work Mills. But by his deſcription of them in the publick Papers, viz. "That that part of his "Machines, which is deſigned for working Mills; "ſuch as Corn, Rolling, Tilting, Sawing, Sugar "Mills, &c. is done by fall of Water," which is underſtood to be Water to be raiſed by his Machines into the Pond again; and to make the ſame Water turn Wheels continually, without looſing any of it.

Or, by the Tide, or ſtreams and falls of Water, &c. therefore it appears, that Mr. Blakey's Invention is of a different Nature from the Preſent.

THE Writer, ſeveral Years ago, apply'd his Thoughts to the Invention of ſuch Machine; which, with much Study and Expence, he hath brought to Perfection, which he apprehends, will anſwer all the Purpoſes of Mills uſually worked by Wind, Water, or Cattle, and be more uſeſul and profitable (in ſome Situations) than any of them. And he will now proceed to ſhew the Utility of it, in Grinding Sugar Canes, and Superiority of it over the preſent Method, or any yet known; and will confine this to that Branch chiefly.

THE preſent Method of Grinding Sugar Canes, being chiefly by Wind Mills, or Cattle Mills, which are worked by Horſes, Mules, or Oxen, (but chiefly Mules) except ſome Water Mills, which are ſo few in the Weſt Indies, that they are ſcarce worth mentioning. It is a very great Expence at firſt to erect the Mills, and purchaſe the Mules, &c. And a conſiderable annual Expence after, to keep the Mills in Repair, and feed the Mules, &c. The firſt coſt of a Wind Mill, with a Cattle Mill, and Thirty Mules; that is, Twenty-four conſtant in Work, and Six in reſerve, to ſupply the Place of thoſe which fail, or refuſe to Work, (which is neceſſary to an Eſtate which works Eight or Ten Coppers) at a moderate Computation may be eſtimated at £ 2000, Sterling, or upwards. And the annual Expence after, to keep the ſaid Mills in Repair, with Corn and other Feeding for the Mules; with Attendance on them, and purchaſing others to ſupply the Place of thoſe which Die, or become uſeleſs by Diſtempers, Accidents, and Age, &c. with the ſaving of Labour of Negroes, and an Overſeer, at a moderate Rate may be eſtimated at £ 632, 16s. per Annum, which will appear by an eſtimate of the Particulars herein.

Beſide great Inconvenience and Loſs by Accidents, which Wind Mills are ſubject to, by ſudden ſqualls of Wind, which often break the Veins and Arms, and ſometimes damage the Shafts, which occaſions delay to the Grinding the Canes in the proper Seaſon; and in Hurricanes, Wind Mills are often blown down in the middle of the Crop Seaſon, to the diſappointment of the Owners, and loſs of a great part of his Crop. For if Canes which are ripe, is not cut before the wet Seaſon comes on, they take a new ſpring or growth, and wont make Sugar, but are cut and carry'd off the Land, or burned as they ſtand; beſide a conſiderable Expence in rebuilding or repairing the Damage. The Danger of which is ſo great, that ſome Planters take the Veins off their Mills, as ſoon as the hurricane Months comes on, when they are moſt wanted, rather than run the Riſque; and Wind Mills being ſo ungovernable, and not ſuddenly ſtopped, occaſion many Accidents, particularly to Negroes; who being of a ſleepy Conſtitution, frequently fall aſleep when they are feeding the Mills; and ſuffer a Hand to be drawn in between the Rollers; and unleſs ſome Perſon happen to be preſent, who has preſence of Mind and Reſolution to cut the Arm off, before the Body is drawn up to the Rollers, they are immediately cruſh'd to Death. Other Accidents frequently happen to People and Cattle, going careleſſly in reach of the Arms of Wind Mills, in the out ſide, when they are going are killed. And the uncertainty of the Wind occaſions much loſs of Time of the Negroes waiting on it; and when it declines ſuddenly, it has not Power to bring about the Rollers, with the Canes it was fed with before, and ſtops until the Arms are ſet back, and ſome of the Canes taken out, and the Mill fed lighter, which takes up a good deal of Time, and this often happens ſeveral times in an Hour; and in a ſtrong Breeze or Gale, the Arms go ſo ſwift, that there is danger of Damage to the Mill, and the Arms are turned out of the Wind, and the Sails taken down to ſtand until it abates, by which much Time is loſt alſo. And the Situation of Wind Mills being confined to Hills, is the moſt inconvenient for the boiling Houſes, on account of the carriage of the Canes up the Hills; ſome of which are ſo ſteep, that Carriages can't go up, but the Canes are carried on the backs of Mules. And thoſe Hills are generally on the out-ſide of Plantations, and at the greateſt diſtance from the ground the bulk of the Canes grow on, which in many Eſtates, takes double the number of Negroes and Cattle to bring in the Canes, which it would do, if the mill and boiling Houſe ſtood in the moſt convenient part of the Plantations; and boiling Houſes ſtanding on Hills, is alſo inconvenient on account of Water, which ſeldom is had on Hills, but by ſinking deep Wells at conſiderable Expence, and are frequently diſappointed of Water; in which caſes they are obliged to carry a great part of the Water they uſe up the Hills. Others, on account of Water, ſets the boiling Houſes in the Valleys, when the Wind Mills are on the Hills, and carry the traſh of the Canes, called Magoſs (which is the Fuel uſed to boil the Sugar Coppers and Stills) down, which takes much Labour, and the Cane Juice is convey'd down in Spouts, in which is much waſte.

It may be ſuppoſed, that the Dung of Horſes and Mules pays the Expence of their Feeding and Attendance. To which it is anſwered, that a like number of horned Cattle might be kept, which would make as much Dung, of much more Value, it being of a cooler Nature than the Dung of Horſes and Mules, and more uſeful in hot Climates, and they would not be ſo expenſive in Feeding, as they would not require any Corn, which is the chief Expence of feeding Horſes and Mules, being fed twice a Day for the moſt part. And the Milk of 30 Cows under any tolerable Management, would produce a conſiderable Profit Yearly, in Butter, Veals, and raiſing young Cattle, at the high Prices thoſe Things ſell for in the Weſt Indies. And in making new Plantations, it is ſeveral Years before Paſture Ground can be cleared, and in order, to maintain a ſufficient number of Cattle, which Employs a great deal of Labour, which would be more profitably employ'd in clearing Ground to plant Canes in, if the Cattle could be wanted.

Cattle Mills alſo are very troubleſome and uncertain; the Mules being very difficult to manage, much Time is loſt in yokeing and unyokeing, and often ſtopping; and the leaſt over-feeding ſtops the Mill, until the Cattle are ſet back, and the Canes taken out, which happens very often, and takes up much Time; and the Cattle not drawing alike, alſo occaſions many ſteps, and takes up much Time, and the Mules are very difficult to break at firſt. And being very vicious, frequently hurt and lame People, and themſelves. Many Inventions have been try'd at different times in the Weſt Indies, to make Cattle Mills work with leſs expence of Cattle, by multiplying Wheels to gain Power. But the Grinding Canes requiring a certain degree of ſwiftneſs of the Motion, as well as a conſiderable Force, (both which is confined to the Strength and Motton of the Cattle) It has been found, that what was gained in Power, was loſt in Time, and the friction of the Coggs took off a great part of the Power gain'd. The Writer has ſeen the ruins of ſeveral ſuch Inventions in different Iſlands, which were made at great Expence, and could not learn that any of them anſwered ſo well as the common, ſimple Method, which have been long and moſt in Uſe. The Writer is inform'd, that great expectation's is had from ſome late Inventions of Friction Wheels; to make them Work with fewer Cattle. The uſe of which Wheels was known and practiced many Years ago, which the Writer ſuppoſes is known to every Millwright in England, or moſt of them, and was practiced by ſome in the Weſt Indies. And it is ſuppoſed, that if they had been found of much Conſequence, they would be ſtill in uſe. But the Writer, on the fulleſt Enquiry, cannot learn that any of them are now in uſe in England, or the Weſt Indies.

The Writer will now proceed to ſhew the Profits and Conveniencies, which he apprehends may be had from his Invention, (to wit)

1ſt. It may be ſet in the moſt convenient ſpot of a Plantation, for Water and eaſy Carriage of Canes, in which muſt be conſiderable ſaving in every Plantation, and in ſome very great.

2d. It is ſo much under Command, that it may be ſtopped in a ſecond or two, and ſet to Work in the like time; and therefore is not ſubject to ſuch Accidents as Wind Mills, or to any which may hurt any Perſon or Thing.

3d. It is always in readineſs to Work; and when occaſion requires, may be worked in the Night as well as the Day, all the Crop Time, or Year round, without ſtopping, except by neglect of the Fire; which immediately ſhews it by the motion being ſlower, or the Engine ſtopping (if it is let very low) for a feew Minutes, until the Fire is raiſed, and is not attended with any other Inconvenience or Delay; except once in five or ſix Weeks; it's neceſſary to ſtop it, to cloath the Peſtin, by taking out a piece of an old Rope which is ſtopped round it, between it and the Cylinder, and to put another in, (which may be done in half an Hour) and to clean the Boiler and Cylinder, which may be done in twelve Hours, including the time the Boiler is cooling. And if it ſhould at any time ſtop by over-feeding, as Wind Mills and Cattle Mills often do, and is not ſoon ſet on to Work again (as before obſerved.) The Fire

Engine may be ſtopped, and Mill ſet back, ſo that ſo much of the Canes may be taken out, that the Mill may be ſet to Work in two or three Minutes. But this won't happen ſo often as in Wind Mills or Cattle Mills, as the Power is always the ſame, and may be fed regular.

4th. The motion of the Fire Engine being regular, and the Force always the ſame, it is not ſubject to any ſudden Shock or Accident, to break or damage any part of the Work, and therefore requires very little Repairs; which the Writer apprehends, for the firſt four or five Years, may not amount to five Pounds Yearly; and Boylers made of Iron Plates, generally laſt twelve or fifteen Years, with ſome Repairs, which is done at ſmall Expence, without taking down any of the Brick Work, by placing plates in the inſide, to cover the Holes, which are ſcrew'd on and caulked between it and the Boyler. But at ſome Mines where they uſe the Water in the Boiler, which comes from Coals which are ſulphurous, it eats the Boilers and they don't laſt ſo long. But ſome are made of Copper, which laſts from 20 to 30 Years, and will Sell for two thirds of the firſt Coſt, when they are wore out.

5th, The Fire Engine and Machine which the Writer propoſes don't require any Expence of a Houſe or Buildings, except ſome Brick Work about the Boyler, and a ſhade about 16 foot ſquare, which may be ſet on Poſts ſet in the Ground, or Pillars of Stone, or Brick, to cover the Machine, the Mill, and People who feed and attend it from the Weather; and to bear ſome ſmall Beams to ſet the Machine on, and ſteady the Rollers. It has been uſual to build Houſes of Stone or Brick, the Walls very thick and high, with very thick Beams, to bear the Cylinder and Laver, and a Roof to cover the Engine, &c. which was a great addition to the Expence of Fire Engines. But of late, a cheaper Method is found to anſwer the end better, by ſetting the Cylinder and Laver on a Frame made of ſix Poſts; three Ground Sills, and two Top Sills; with ſhort Beams to ſet the Cylinder and Ciſtern, &c. on; which being ſhort, don't ſink, when the Peſtin is coming down, as Beams in Engine Houſes uſually do, on account of the length of the Beams, by which the tops of the Boilers are frequently damaged; and the covering a Fire Engine from the Weather, is of little or no uſe, as the Laver is the chief part of it which can be hurt by the Weather, by decaying ſooner. But as one half of moſt Lavers where the Engines are in Houſes, are in the out-ſide, are expoſed to the Weather; when that end is decayed, the other end can't be of any uſe in the Work.

6th. It requires little Attendance, except once in about two Hours to turn a Cock, to let ſome of the hot Water which comes from the Cylinder, into the Boiler, to ſupply the Place of what the boiling ſends up in ſteam into the Cylinder, to make the Vacuum, which will be explained in an Explanation of the Plans annexed. But a better Method is practiced by ſome, which is to ſet the Cock to a Gauge, to let as much and no more Water in the Boiler, than ſupplies the place of what aſcends up in ſteam, which takes leſs Attendance, and is more regular.

7th. The Fire Engine, by a ſmall Pump, which is worked by its own Power, to raiſe Water to ſupply the Injection to make the Vacuum, is firſt let into a Ciſtern, (which is ſet on the Engine Frame) ſome 15, ſome 20 Foot high, will alſo ſupply the boiling Houſe, and other uſes of the Plantation, and keep a continual ſupply running into the Worm Tubs, which will keep the Worms cooler than two Negroes uſually do, which will prevent conſiderable Loſs, which is ſuſtained by the evaporation of Spirits which comes hot from the Stills; and alſo prevent a bad Smell and Taſte, which Rum takes from Worms when they are not kept cool, by the negligence of

Negroes; which Water the Engines will at the ſame time raiſe out of Wells of any moderate depth, ſhould they be at 50 or 500 yards diſtance from the Engine, which will be deſcribed in the Plan of an Engine, and Explanation of it annexed. And in Eſtates where Water can be ſpared, it may be convey'd from the ſaid Ciſtern in Spouts, to water plant Canes when in danger of looſing by Drought.

8th. It is known to every Planter, that by the uncertainty of the Wind and Cattle falling, or not being ſufficient, they frequently meet with great diſappointment of getting Canes Ground when they are ripe, and in the beſt Order for it; and alſo are frequently obliged to take the Opportunity of the Wind, and grind Canes before they are full ripe; both which is attended with conſiderable Loſs, in the Quantity and Quality of the Sugar. Neither of which he apprehends can happen in an Eſtate where the Mill is worked by a Fire Engine, ſuch as the Writer propoſes; that is, one of 30 Inches diameter in the Cylinder. The Power of which, on the outſide of the middle Roller, to bring it about, being 14800 lb. (which will appear by the annexed Plans) which the Writer is poſitive, is more than is neceſſary to work the Rollers, when fed as full as Wind Mills uſually are, in ſuch Winds as a Planter would deſire; in which Rollers go round about five times in a Minute; at which rate, very few Days (at leaſt not half the Crop Seaſon) there is ſix Hours in a Day ſo much Wind, as to work a Wind Mill. And as the Writer has calculated the Machine to turn the Rollers five times a Minute, and as it may go conſtant without any ſtop, he preſumes there can be no doubt of it grinding Canes to employ ten Coppers; and if the Speed ſhould not be ſufficient, it may be increaſed, by enlarging the Trunnell Head, to go ſix times round in a Minute, by leſſening the Power a ſmall Matter, which will be ſufficient after; or the

Power may be increaſed by a larger Cylinder; but he apprehends the Power of the Engine propoſed, will be ſufficient to grind as much as will ſupply ten Coppers, in eight or ten Hours.

9th. The ſaving of Labour will be conſiderable; for a Wind Mill requires at leaſt, three Negroes to attend the Rollers, two to carry in the Canes, and one to carry out the Traſh; and one who underſtands to manage the Sails, conſtantly watching the Wind and Squalls. And a Cattle Mill requires three to attend the Rollers, one to bring in the Canes, one to carry out the Traſh, and four to drive eight Mules to any Purpoſe, and two are chiefly employed in drawing Water out of the Well. In all eighteen in this part of the Work; and a white Overſeer conſtant in the Yard, to oblige them to do their Duty; whereas a Mill worked by a Fire Engine, will require only three to attend the Rollers, one to bring in the Canes, and one to carry out the Traſh, in all five. For although there ſhould not be more Canes Ground in a Wind Mill and Cattle Mill, in which there are three employ'd in carrying in the Canes, yet one will be ſufficient to carry the like quantity to ſupply a Fire Mill, partly on account of the Carts diſloading ſo cloſe, as within eight or ten Foot of the Rollers, that an able Hand may take them up, and feed the Mill without any Perſon to bring them in to him; but chiefly on account of the conſtancy and regular feeding the Mill; the force of it being always the ſame, and the motion ſeldom varying much, but in a Wind Mill on account of the danger to the Mill, when the Wind blows hard, if the Rollers are not full fed, at which time it takes more Canes than one can bring in to a Wind Mill, it is neceſſary for two to attend, although neither they, or any of the Hands who attend the Rollers, have full Employment half the time, on account of the uncertainty of the Wind; from which it appears, that in this part of the Work, there may be a ſaving of thirteen Hands, but allowing that ſome Days when the Wind anſwers the Hands at the Cattle Mill are otherways employed; for which the Writer will ſubſtract three conſtant, and ſuppoſe the ſaving only ten, which he apprehends is worth twelve Pounds each yearly, including Maintainance, Cloathing, Feeding, Levies, Doctors, and loſs by Deaths, &c. which amounts to £ 120, beſide the Wages of a white Overſeer, with his Maintainance, may be computed at £ 60.

The Eſtimate of the yearly ſaving is, (to wit)

	l.	s.	d.
The Labour of ten Negroes as before	120	0	0
A white Overſeer as before ——	60	0	0
A Carpenter, and a Smith extraordinary, to keep the Mills in Repair, and their Maintainance £60 each	120	0	0
Corn to feed 24 Mules while Working, 2 Quarts each twice a Day, is 3 Buſhels per Day, ſuppoſe for 8 Months each Year, or 34 Weeks, is 612 Buſhels, at 3 s. per Buſhel ——	91	16	0
Purchaſing Mules to keep up the Number, five yearly, at £20 each	100	0	0
Sail Cloth, Ropes and Twine for the Wind Mill, computed at	30	0	0
Iron, Nails, Planks, Timber, &c.	15	0	0
Negroes Time in bringing Cane Tops to the Pens, and watching Cattle in the Paſture, and other Attendance, computed at 4 conſtant, at £12, ——	48	0	0
Carried over—£	584	16	0

	l.	s.	d.
Brought over—£	584	16	0
And every Negroe on the Plantation except the Boylers and Houſe Servants, go out every Morning before the Sun is up, and pull and bring in Graſs by the Roots, which they carry in to feed the Cattle in the Pens, which prevents their going ſo regular to other Work; and going out in the Dew ſo early bare footed, brings Fevers on ſome; and on the whole it may be computed, that the Labour of four more conſtant may be loſt by this, at £12 each	48	0	0
Total—	632	16	0

If the Writer has committed any Error in the above, or any other of his Eſtimates, he prays it may not be imputed to any deſign to impoſe on the Publick, it being much lower than the Informations which he received from Perſons who are well acquainted with Sugar Works.

N. B. Thoſe who Work at a Mill which is worked by a Fire Engine, wont require an Overſeer, for the Boylers who attend the Coppers, immediately diſcovers the leaſt neglect of the Firemen, by the boiling of the Coppers; and as it is propoſed that the Flame from one of the Clarifiers may ſupply the Boiler of the Engine, the motion of the Engine will oblige the Perſon who feeds the Mill, and others who Work at it, to their Duty alſo, otherwiſe it may be known to a white Overſeer, who uſually attends in the boiling Houſe, to keep the Boilers and others to their Duty, who may have an Eye to the People at the Mill at the ſame time, but a neglect of the Negroes cannot ſubject the Engine or Mill to any Damage.

It is preſumed, that from what has been ſaid, it appears, that in Plantations the moſt conveniently ſituated, which Employ eight or ten Coppers, that £632 16s. may be ſaved yearly by a Fire Mill; and in Eſtates not conveniently ſituated may be ſaved the Labour of many more Negroes beſide, it may be ſuppoſed from five to twenty, in the Carriage of Canes, Fuel, Water, and otherwiſe, and the Labour of many Mules and other Cattle. Alſo conſiderable Benefit which may be had from keeping horned Cattle in the place of Mules, and ſaving of the waſte of Spirits, and preventing their being ſpoiled by neglect of keeping the Worm Tubs cool, as before; and a Mill may be worked by the Engine at the ſame time, to grind Corn for the Negroes. The Writer apprehends that the ſavings before-mentioned, with other Advantages, particularly the certainty of having Canes ground at all times when they are in the beſt condition for it, without any delay or diſappointment, or danger of looſing any part of the Crop by a ſecond Spring, which will alſo be an Advantage in the next years crop, by Canes being cut as ſoon as they are ripe, will have the longer time to grow, and the benefit of the wet Seaſon to aſſiſt them. Alſo Planters and Managers being eaſed of continual fears of Accidents to the Wind Mills and Cattle, or diſappointment of a Days Work, to occaſion late Hours, by Canes not being ground, &c. &c. muſt appear ſo great, that moſt Planters will find conſiderable account in laying aſide their Wind Mills, and Cattle Mills, and putting up Fire Mills, and in removing their boiling Houſes, where the Situation is Inconvenient.

10. The Benefit to thoſe who make new Eſtates out of Wood Land, will be much greater than any who have improved Eſtates. For beſide all the yearly Savings and Advantages which every Planter may enjoy as before-mentioned, they will ſave the

greateſt part of the Expence of building the Mills, and purchaſing the Mules, as before computed to upwards of 2000, which will be ſupply'd by the Fire Engine and Machine, which with a Sugar Mill, and every thing belonging to them, the Writer propoſes to deliver in London, in ſuch order, that the whole may be ſet up to Work in ten or fifteen Days after the arrival in the Plantation. He is not at preſent prepared to ſay with certainty, what he may Sell them for, but thinks it may not exceed Seven Hundred Pounds. But any Perſon by enquiring of him, or his Agents, or Factors, may be informed. Another Advantage which is very conſiderable is, that all the Negroes may be immediately employ'd in clearing Ground, and planting Canes, whereby more Canes may be planted in the firſt Year, than is uſual in three, the bulk of the Negroes (and thoſe the Ableſt) being uſually employ'd the firſt two or three Years, in clearing Ground for Paſture, to provide for the Maintainance of Mules, &c. to grind the Canes, and in quarrying and drawing Stones and Timber; and burning and drawing Lime, Sand, &c. to build a Wind Mill and Cattle Mill, and a circle for the Cattle Mill, and carrying in Earth to raiſe both, &c.

11th. That all theſe Advantages may be had, without any Expence of Fuel, more than is uſually conſumed in boiling the Sugars; by ſetting the boiler of the Engine cloſe by, or partly in the Gavel of the boiling Houſe; and one of the Clarifiers, (that is, the largeſt Coppers) which for common contain from, about 250 to 300 Gallons, next the ſaid Gavel, ſo as the Flame from the Clarifier may come to the Boiler, to boil it, which will be attended with little Inconvenience to either, as the Engine may be ſtoped at any time, without ſtoping or leſſening the Fire under the Clarifier. It may be queſtioned, how the Fire under one Copper or Boiler, can boil another; but the Writer apprehends, that every Sugar Planter muſt know, that in moſt Works, the Fire which boils the ſmalleſt Copper, called a Teach, which don't for common contain more than from 60 to 70 Gallons; alſo boils the next largeſt Copper of 100 to 120; and the next to it of 140 to 160. And in Works of ten Coppers, the next to it of 180 to 200 Gallons; and it is obſerved, that the largeſt and fartheſt from the Teach, boils with as much Force as the Teach, or any of the other three; and the Flame after performing as aforeſaid, paſſes through the Chimneys (which are upwards of 20 Foot high) with ſo much Violence, that it flames out of the tops of them, and ſplits them unleſs they are bound with Iron, and the quantity of Water to be boiled in the boiler of the Engine (ſuch as propoſed) is not more in Proportion to the Clarifier, than the ſmalleſt of the three which are boiled by the Fire of the Teach is to it; and the only Inconvenience attending the ſetting the Clarifier next the Gavel, will be to ſet the Teach in the Place where the Clarifier uſually ſtands, and the other three Coppers between them, in the ſame order they uſually ſtand in, and to remove one of the Chimneys, which it is preſumed, will be as convenient to the Work, as the uſual method of ſetting it, which will appear by a Ground Plan of a boiling Houſe annexed.

It may be objected by ſome Readers, that the light Fuel, ſuch as uſed to Sugar Coppers, may not have ſufficient heat for the Boiler of a Fire Engine; and that Coal only is uſed in England, or will anſwer, which can't be had in the Weſt Indies, and that no other Fuel is fit for it, on account of the conſtancy of it. To which it is anſwered, that ſome of the Fire Engines in Cornwall, which are at the greateſt diſtance from the Coal Mines, are frequently boiled with Wood. And Mr. Skiler, of New York in America, has no other Fuel to work an Engine, which lifts the Water out of his Copper Mines. And the Writer preſumes, that it is known to every Planter, that the

Sugar Coppers boils with ſo great force, that ten Coppers from 60, or to 250, or 300 Gallons, heats and raiſes in ſteam, from 3000 to 3500 Gallons of Water, (which is in the Cane Juice) in a Day, or about 16 Hours; and that no Boilers can boil more conſtant than they do, it being the whole Buſineſs of a Negroe to attend one Fire, which is fed by a little at a time, and is never ſuffered to fall, except in the time the Liquor is clarifying. And Engine Boilers are ſet to more Advantage to get the benefit of the Flame, than Sugar Coppers will admit of, there being a Flew all round the Side, from the turn of the bottom, near as high as the ſurface of the Water in it; through which the Flame paſſes very ſwift, occaſioned by the draught; and being confined, has more Power than Flame which ſpreads and only flies about the ſides of the Coppers can have, and the tops of the Engine Boiler being always covered, leſs Fuel will keep it boiling, than Coppers which are open, and expoſed to the Air, as Sugar Coppers are.

It may be objected alſo, that the Fire of the Clarifier is not always conſtant, but muſt abate at times, while the Liquor is clarifying. To which it is anſwered, that this happens only about ſix times in a Day to each Clarifier, and half an Hour each time is as much as for common, the Fire abates each time, and the Engine will not ſtop, only move ſlower, as inſtead of the Rollers going round five times, they may go only three or four times in a Minute. But although the Writer is poſitive, that it will grind more than will ſupply ten Coppers, with the Fuel of the Clarifier, he purpoſes to ſet the Boiler and Clarifier ſo, as each may boil with ſeperate Fires, and either boil and the other ſtand, as well as both to boil with one Fire. which will be deſcribed in the Plan; ſo that if there ſhould be occaſion, the Fire of the Clarifier may be aſſiſted with ſome Fuel under the Boiler, while the Liquor is clarifying, which may be done always by a very ſmall quantity of Fuel, ſhould there be occaſion. But if any Perſon ſhould entertain any doubt of the Flame from the Clarifier, ſupplying the Boiler, or Inconvenience by it, the Writer apprehends that as much of the tops and blades of the Canes, (called Wora) may be ſpared off every Eſtate, as will ſupply the Boyler, which is the lighteſt Fuel; and he preſumes that every Planter knows that it boils the Coppers ſtronger than the Cane Stalks, (called Maggoſs) or any other Fuel, which ſome let lie on the Ground and rot; but others carry it off or burn it on the Ground, being of opinion, that it is injurious to the growth of the Canes, and harbours Rats and other Vermin, which damages the enſuing Crop, eſpecially where Canes were rank, and lie thick on the Ground; and if a ſmall part is left to cover the young Sprouts of the Canes, from the ſcorching heat of the Sun, it will be of more ſervice than the whole. But there is not the leaſt reaſon to doubt of the Flame from the Clarifier being ſufficient for the Boiler. The Writer is poſitive it will be by much too great, as it appears, that a Boiler don't require any exceſſive degree of heat to keep it boiling. For if the heat is exceſſive, the Water will mix with the ſteam, as it does in Pots and Tea Kettles when they boil over, and as it does in Fire Engines when the Fire is too ſtrong; at which time the ſteam can't aſcend up into the Cylinder, to ſupply the place of Air to fill the Vacuum, (which is the uſe of ſteam) to let the Peſtin riſe, and the Engine will ſtop, until the heat abates. But Cane Juice being of a weightier Body than Water, don't mix with the ſteam and boil over, as Water does by exceſſive ſtrong Fire, only throws up very ſtrong, &c. as Wort does, otherwiſe the Coppers boil ſo ſtrong, as it would throw all out of the Coppers; the heat however may be leſſened, or entirely taken from the Boiler in an Inſtant, by letting down a Damper in part or whole, and at the ſame time to lift another Damper, to carry the Flame from the Clarifier another Way, (which Dampers will be deſcribed in the Plans before-mentioned; and if ſome Wood is put under the Boiler at Night, and one of the ſaid Dampers let down, and a Plank ſet on the outſide to cover the Fire Place, and Aſh Hole, and ſome Clay daubed about the ſides of the Plank, to ſtop the Air. The Boiler may be kept ſo warm, as the Mill may work in leſs than a quarter of an Hour, after the Fire is put to it in the Morning, and if the Fire under the Clarifier (in the uſual way it Works) ſhould be found too ſtrong for the Boiler, one of the Flews which goes round one half of the ſide of the Boiler, may be ſtoped, or part of the Fire Room under it may be filled up with Brick or Clay, to cover part of the bottom from the Flame, ſo as the Power of the Fire on it may be leſſened as much as may be neceſſary, by which means it may be proportioned ſo, as the uſual Fuel under the Clarifier will ſuit the heat the Boiler requires; or the Flame may be leſſened at Pleaſure, by letting down the Damper between the Clarifier and Boiler, ſo much as may be convenient; and if this ſhould be found to leſſen the boiling of the Clarifier, by leſſening the Draught, as much of the other Damper may be lifted, as will give the Clarifier the ſame Draught it had; and two Poles may be fixed, one end of each over the Dampers, and the other ends to reach to the Place the Perſon ſtands to feed the Fire (as uſual in Corn and other Mills to lift the Sluices) by which he may leſſen or increaſe the Flame to the Boiler, (by raiſing or lowering the Dampers) without leſſening the Draught or Heat to the Clarifier; or the Poles may be marked to a Gauge to ſuch height, as may be found to anſwer the Clarifier and Boiler. And a ſmall Pipe may be fixed, one end to the Boiler, and the other end to the Fire Place, which by the ſteam which will come through it, the Fireman may ſee the leaſt alteration of the Flame to the Boiler, and leſſen or increaſe it in two or three ſeconds by the Dampers; ſuch Dampers are uſed in the Fire Engines in London, to regulate the Fires, which for common is about fourteen Inches broad, and eighteen Inches to twenty long; and while the Water is heating, it is lifted up the whole length, to increaſe the Draught, to make the Coals flame much. But as ſoon as it boils, the Dampers are let down more or leſs as required, to leſſen the Draught to regulate the Boiling, ſome to five or ſix Inches only of it open, which is a proof, that a boiler of a Fire Engine don't require exceſſive heat to keep it boiling. And it is evident, that Boilers worked by the flame from a Clarifier, muſt boil more conſtant and regular than thoſe which are boiled by Coal Fires; for the uſual method of the latter is to ſuffer the Fire to fall ſo much, as the motion of the Engine is obſerved to be leſſened, before any more Coals are put on, and often the Grate is choaked by the cinder of the Coals, which prevents the Air from coming thro' the Coals, and thereby leſſens the Flame, until the Grates are cleared; whereas the Fire of a Clarifier being conſtantly fed by a little at a time, with light Fuel, which takes Fire very quick, and keeps a more conſtant Flame than Coals can do, and produces a much greater quantity of Flame.

Coal Fires under the Boilers of Fire Engines, and Brewers, and other Boilers, appears by the Noiſe they make, to be of great force, which Noiſe is occaſioned by the Grates being ſet very high, for common ſix or ſeven foot from the Hearth, to draw much Air, to make the Coal burn ſo as to produce a ſufficient quantity of flame, which would not otherways, unleſs the Coals were of a more flaming kind than is uſed to Engines in London; and when the Dampers are up the whole length of eighteen or twenty Inches, the Draught muſt be very great, and flame very much. But when they are ſet down to five or ſix

Inches of them only open, it muſt appear, that the draught and flame is very much leſſened; but the Fuel uſed at Sugar Works burning very free, don't require ſo great draught, and the Grates for common are ſet only two foot and a half from the Hearth; and although it don't make ſo much Noiſe, yet it produces twice as much flame, which muſt be more than ſufficient to ſupply a Boiler of an Engine to keep it Boiling. The Power of flame from light Fuel appears by the boiling Pots and Tea Kettes, which are ſooner boiled by a few Chips or Shavings, than a ſtrong Coal Fire.

It may be objected alſo, that in ſome Eſtates the Wells don't afford more Water, than barely to ſupply the Boiling Houſe, Diſtillery, and other uſes of the Plantation, and none could be ſpared to ſupply the Injection and Waſte, which may be in boiling by ſteam, &c. To which it is anſwered, that the ſame Water which is uſed for the Injection, may be cooled in a Pond or Well for the Purpoſe, and uſed again, which is done at ſome Coal Mines where the Water is ſulphurous, and eats the Boilers. And as to the waſte by ſteam which riſes from the boiling the Water, there is no viſible Waſte, for all the ſteam raiſed paſſes through a Pipe into the Cylinder, and is there condenſed by the injection of the cold Water, and mixes with the Injection Water, which is let into the Boiler, (that is part of it) to keep it to a proper Depth, ſo that there is no viſible Waſte, except by ſome ſteam which comes out of two Pipes, one called the Guard Valve, and the other the Snifting Pipe, which is very inconſiderable. And if the Plantation well can ſpare five or ſix Hundred Gallons of Water a Day, it's preſumed, it may ſupply the waſte by the Engine, Worm Tubs, and other uſes alſo, as the hot Water from both may be let into a Pond or Well, to cool; and when cold, will come about again into the Engine Well, without any expence of Labour, and be pumped up into the Ciſtern again by the Engine. The moſt convenient method of cooling it is, to dig the Pond or Well about twelve foot diameter, and twelve or fifteen foot deep (which the Writer will call a Cooler,) in which ſet a Trunk, which may be made of Plank, or a Tree bored, as for a Pipe, with a Hole or Holes about a foot from one end; which end is to be ſet in the bottom of the Cooler, to let in Water, which ſet upright in the ſide next the Engine, and fix a Pipe from the upper end of it, to convey the cold Water, (which will come up through it as the warm Water raiſes the ſurface in the Cooler) to the Engine Well, which will alſo be cooled as it ſinks down in the ſaid Engine Well. Care is to be taken to have the Cooler and Engine Well full, when the Crop time comes, by drawing the Water as it comes from the Spring in the Plantation Well, for ſome time before, or it may be filled with Rain Water, which may be convey'd to it by ſmall Drains, to be made for the Purpoſe. And if there ſhould be any doubt of the Water in the Well not being ſufficient to ſupply the Waſte, another Well, ſuch as the Cooler, may be made for a Reſervoir, and filled with Rain Water, in which a Pump may ſtand, and at any time when any is wanted, it may be lifted and convey'd in ſpouts or Pipes to the Engine Well, both which Pumps may be worked by the Engine at the ſame time, or ſeperate, by unhooking a Chain. The motion of the Pumps are ſlow and regular, the ſtroke being three foot long they don't wear the Leathers ſo faſt as common Pumps, but except the Engine Pump, they will be little uſed, the deſign of the reſt being only to raiſe ſo much Water as to ſupply the Waſte. If one Cooler and one Reſervoir ſhould not be thought ſufficient, two of each may be made, or if three or four of each ſhould be neceſſary, it's preſumed that the Expence will be no objection, where ſo great Benefit is to be had. Bot it's preſumed, that at moſt two of each will be ſufficient, if the Plantation Well ſhould not produce any. For by making proper Drains, and keeping them open, the Reſervoirs will be filled every heavy Shower, to ſupply what may be taken from them.

It may be objected alſo, that a Fire Engine is very curious, and difficult to underſtand, or manage, and that it may not be practicable to make Negroes underſtand them, ſo as to manage them. To which it is anſwered, that at Colleries it is neceſſary to have Men of Ingenuity and Experience, to contrive and direct the ſinking Shafts, and ſetting down large Pumps in deep Mines, and to Work the Coals, and other Works under Ground. And in London the forcing large bodies of Water upwards of 100 foot high; and Works under Ground requires Men of Ingenuity and Experience alſo. But although Fire Engines are very curious, and appears miſterious to thoſe to whom the Principles of them have not been explained, yet there are few Machines more ſimple or eaſier underſtood, or managed, when they are fixed to Work, which will appear by a Plan and Explanation of them annexed. And any Man of tolerable Capacity (eſpecially if he is a Carpenter) may be inſtructed to manage them, and to ſet them up to Work, by attending ten or fourteen Days. They are frequently attended by Boys not more than twelve Years old, and Women at the Colleries for ſeveral Days together. But it's preſumed, that Men of Experience may be had on moderate Terms, to go with them to the Weſt-Indies, (ſhould it be thought neceſſary) who might ſupply the Place of an Overſeer for ſome time, until others about the Works were made acquainted with them.

The Writer apprehends, that by the annexed Plans and deſcription of them, &c. the Principles of a Fire Engine and his Invention to apply the force of it to a Sugar Mill, will appear ſo ſimple, and will be ſo eaſy underſtood by every Gentleman who knows any thing of a Sugar Mill or Mills of any kind, as to enable them to judge of the whole, and leave them without any doubt of it anſwering the Deſign.

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AN EXPLANATION

OF THE

PLANS ANNEXED.

PLAN A repreſents a ſide View of a Fire Engine, and the Manner in which the force of it is apply'd to the Machine, to work a Mill to grind Sugar Canes, and a Corn Mill at the ſame time: alſo the Method of working Pumps by the Power of it, to lift Water out of Wells at any moderate diſtance, (to wit.)

A A Is a large piece of Timber called a Laver, 20 Inches deep, 18 broad, and 22 foot long. B B a Cylinder 8 foot and a half long, and 30 Inches diameter. Figure 1 the Peſtin, ſuſtained by the Chain D. E the Fire Place. F F the Boiler, 6 foot wide at bottom, 7 foot at 2 foot high from the bottom, (being the wideſt Part) the whole depth about five foot; the under part is the depth of the Water; the upper part is a Reſervoir for Steam. G the Steam Pipe, about four Inches diameter; through which, the Steam paſſes into the Cylinder. 2, A Plate of Iron called a Regulator within the Boiler, ſo broad as to cover the end of the Pipe, which opens, and lets the Steam into the Cylinder, as ſoon as the Peſtin is down, and ſhuts as ſoon as it is up, which is fixed on an Axis. 3, which goes up through the top of the

Boiler. 4, A Rod of Iron fixed on the Axis, to turn it and move the Regulator. 5, Another Rod of Iron which is let through the end of it, with ſeveral Holes for a Pin to be moved, to lengthen or ſhorten it as the Axis may require to be turned more or leſs. 6, 6, Is two rods of Iron bent, which, with 5, is fixed on an Axis 7, 7, which Rods are moved by the Pin 11, in the Working Beam H H, as it is moved up and down by the Laver, and opens the Regulator, to let the Steam into the Cylender, which fills the Vacuum, and ſupplies the Place of Air, and takes off the Preſſure of the Air on the Peſtin, which lets the Peſtin riſe, and ſhuts it as ſoon as the Peſtin is up. I, I, a Pipe, which brings cold Water from the Ciſtern K, to the bottom of the Cylinder at 8. 9 Is a Cock which is opened by 10, it being moved by the Working Beam alſo, in the ſame Manner the Regulator is moved, (only with ſome ſmall Variation) which Cock opens as ſoon as the Peſtin is up at the proper highth; and the preſſure of the Water above, forces it through a Cap which is on the end of the Pipe within the Cylinder, (in which ſome make only one Hole, others three) through which it is forced up, and ſtriking againſt the bottom of the Peſtin, is divided into ſmall Drops, and condenſes the Steam, which makes a Vacuum in the Cylinder; at which Inſtant the Air preſſes on the Peſtin, and brings it down, and the Steam Pipe opening as ſoon as the Peſtin is down, the Steam ruſhes in and fills the Vacuum, which takes off the preſſure of the Air on the Peſtin; and the Injection Cock opening as ſoon as it is up, condenſing the Steam, and making the Vacuum (as before) returns the Peſtin. And ſo by means of condenſing and rarifying the Steam alternately within the Cylinder; the Laver conſtantly moves up and down, by which Motion the working Rod T is moved up and down, and moves the half Wheels U, U, alternately. The uſe of thoſe Wheels will be deſcribed in the Explanation of Plan B. R is a Box to contain half as much Weight as the preſſure of the Air on the Peſtin, in the time of the Vacuum, which is ~~Eight~~ 14 Pounds on every ſquare Inch, ſuperficial Meaſure. But the uſual Calculation by which Engines are made, is only Seven Pounds, which moſt Engineers agree in, that an Engine Works with eaſe, clear of all Friction, and working the Pump to raiſe Water to ſupply the Injection. It is ſuppoſed that a Cylinder of 30 Inches diameter, will be more than ſufficient for the preſent Deſign, being 706 ſquare Inches, which at Seven Pounds per Inch, is 4942 Pounds; which Power the Machine increaſes ſo much, as to Work with a force equal to 14826 Pounds, on the outſide of the middle Roller of the Sugar Mill, to bring it about, (except what it may be leſſened by the friction of the Cogs) which will be explained in Plan B. But as the Power being greater than is neceſſary, can't be attended with any Inconvenience, except that it may grind the Canes faſter than the Juice can be boiled; (in which Caſe, the Engine may ſtand until the Juice is wanted) The Writer thinks it better to have more Power, than run any riſque of it being too little, eſpecially as it may be profitably employed to other uſes; as working other Mills at the ſame time, or raiſing Water, to Water Canes, where it can be had at any moderate diſtance, which the Writer apprehends it will do, and force it in Pipes under Ground, to any Ground in a Plantation, not more than 30 foot higher than the ſurface of the Water from whence it is lifted; and at the ſame time Work the Sugar Mill; which Water may be convey'd in ſmall Spouts. to every Cane Piece in a Plantation, which don't lie higher than the Water is raiſed. And if the Water to be lifted ſhould lie at a great diſtance from the Engine, and require to be raiſed higher. The whole force of the Engine may be apply'd to it, at any time when the Mill is not grinding Canes, in the Day or in the Night, at a ſmall Expence of Fuel, as it is ſuppoſed, that it will raiſe as much in two or three Hours, as may be wanted each Day, and by this it may be raiſed 100 or 150 foot high. Pipes of 5 Inches diameter, will be ſufficient for this uſe, which may be imported from North-America, at a moderate Expence. And the ſpouts alſo, which latter may be removed from one piece of Canes to another, as there may be occaſion. The reaſon for putting one half of the Power in the Box, on the Rod is, to give the ſame force on one half Wheel when the Rod moves up, as on the other when it returns down. 22, 22, Four pieces of Timber, one on each ſide of the Working Rod above, and the like below, with a notch in each for two ſliders, which are to be fixed on two ſides of the Rod, to run in the notches, to prevent its giving way by the friction of the Cogs. L, a Frame, in which the Axis of the Iron Rods are ſet. M, a Pipe called a Snifting Clack, in the end of which near the top, is a Plate of Braſs, which lifts up eaſy, being ballanced to very near its Weight, by the Weight 12. The uſe of which is to let out what Air may be in the Cylinder, when the peſtin comes down. N is called a ſinking pipe, the uſe of which is, to convey the Injection, and Steam Water, (which mixes in the Cylinder to O,) which is a ſmall Ciſtern called a hot well. 13, A Cock in a Pipe, called a feeding Pipe, to let water from the Hot Well into the Boiler. 14, A warning Pipe, out of which the Steam will come, when the Water is too low in the Boiler. 15, a Pipe called a Steam Clack, in the end of which lies a piece of Braſs, which riſes by the force of the Steam, when there is more Steam in the Boiler than the Cylinder takes, and lets it out. It is alſo uſeful when the Engine is to ſtand, to let out Steam, which is done by pulling the Rod 16, which will alſo ſtop the Engine. P, a Pipe which conveys Water from the Ciſtern K to the Cylinder, to cover the Peſtin ſeveral Inches deep, to prevent any Air from getting into the Cylinder. 17, A Cock to be opened ſo much, as not to let more Water in than is neceſſary. 18, 18. A Pipe to let the Water out when it is too much, and convey it to the Hot Well O. Q Q Q a Force Pump, to raiſe Water out of the Engine Well, and force it up into the Ciſtern K. V, V, two Lavers, to be worked by the Laver A, A, and one Rod, which may lift Water out of three different Wells at the ſame time, or ſeperately, by the Pumps W W W, both Lavers being moved by the Rod and Chains X X X; and the Water is convey'd to the Engine Well Y Y; by the Spouts Z Z Z. 18, 18, 18, is Rollers, about 2 foot diameter, (or Lavers of the ſame diameter will do as well) for the Chains to move eaſy on. 19, 19, ſmall pieces of Timber, about 2 Inches ſquare, to be join'd together, end to end, by ſtraps of Iron and Pins, (called a Slider) to reach from the Engine to the Well, which ſlider is bore by ſmall Timbers ſet up in the form of 20, 20, 20. On the top of which Bearers are ſet to reach from one to the other, to lay ſmall Rollers on, about 3 or 4 Inches diameter, for the ſlider to move eaſy on, which may be ſet ſo high, as not to be in the way of People about the Works; but where it won't be in the way, it may be bore by Poſts ſet in the Ground, from a foot to four foot or upwards, as may be found moſt convenient; and if it ſhould not be convenient to carry the ſlider in a direct Courſe, by ſetting a Roller or Laver at every Square or Angle, it may be carried different Courſes, which will appear in the Plans. 23, 23, Is two ſtrong bars of Irons; one on each end of the Laver A A, to ſtrike on four ſprings of Wood, two under each Bar, which are laid on two Beams, one on each ſide of the Laver the whole length of it. That on the end ~~8~~ 24, is to ſtop the Peſtin from coming too low in the Cylinder. And that on the other end ~~24~~ 5, is to ſtop the Rod from going too far down, and to reſt the Laver on when the Engine don't work.

It may be objected, that if at any time the feeding the Mill ſhould be neglected, the weight on the Rod being 2471 Pounds, will have no Ballance but the Peſtin, and will riſe faſter than uſual, as the Steam will fill the Vacuum in the Cylinder, faſter than it does in working Pumps; which will leſſen the power of the Air on the Peſtin ſo much, as to let the Rod come down with ſome Velocity; and the Bars may ſtrike with ſo much force on the Springs, as to bring the ends of them to ſtrike on the Beam; which lying ſolid, will occaſion ſuch a ſhock as to endanger the breaking the Chain, &c.

To which it is anſwered, that this and a ſtop which the Rod in all Engines uſually make, of about a ſecond, before it returns down, are Inconveniences, which if not provided for, the Machine would not be of ſo much uſe. But the Writer has provided a Remedy, which is, by an Injection of part of the Water near the top of the Cylinder, a little below that part to which the Peſtin ought to riſe, as near the time the Injection Cock opens below as may be, by which the Vacuum is made in an inſtant, after the Peſtin paſſes the Holes, and can't at any time riſe 6 Inches higher. And the Peſtin is hung to anſwer the height it ought to go, to ſuit the Injection; and the Injection is regulated ſo, as to inject as much Water as may be found neceſſary, and no more; by which the end of the Laver can never go ſo low, as to let the Bars ſtrike on the Springs, ſo as to occaſion a ſhock as it does in Working Pumps as before. And the Water coming directly from the Ciſtern through the Pipes, (very cool) and being forced by the preſſure of the Water eight or ten foot above, comes very quick into the Cylinder and makes the Vacuum in an Inſtant, and therefore the Peſtin returns down as quick as it returns up, by the Steam filling the Vacuum, in which there is no time loſt, when the Regulator is ſet to open the Steam Pipe in time.

It may be queſtioned by ſome, if the Injections above may anſwer the end propoſed, not having Experience of it, and may be alledged, that if the making the Injection ſooner would prevent the Peſtin from going too high, or not returning ſo quick, that the Cock may be opened ſooner below, and the Injection made ſooner.

To which it is anſwered, that if the Injection Cock ſhould be opened any ſooner than the uſual time, or ſo ſoon as it would require, when the Peſtin goes up with uncommon Vilocity; it would at other times make the Vacuum, before the Peſtin would come to its ſtroke; and the opening the injection Cock, depending on the motion of the working Beam, which is ſooner when the Fire is high, and later when it is low, makes the time of making the Vacuum uncertain, which obliges thoſe who attend Engines to watch the Motion, and often to remove the Pins in the working Beam, or to lay on, or take off pieces of Leather, to keep the Peſtin near to the ſame ſtroke, otherwiſe the Bars would often ſtrike. And the Injection Pipe in moſt Engines being from eight to nine foot from the Peſtin, at the time of Injection; and the Water taking ſome time in coming through one or three ſmall Holes, (although it comes very quick, and coming ſo long away through the ſteam, muſt be ſomewhat warmed by the heat of it and the Cylinder, and can make but a very ſmall Vacuum at firſt ſtriking on the Peſtin, not more than ſtops it until more comes, which is the reaſon of the ſtop in the return of the Rod down, which the Writer preſumes every Perſon who attends an Engine knows.

Theſe Injections are made in two parts, through two Holes made in the Cylinder, a little below the Part to which the Peſtin riſes, one oppoſite the other and the water from both meets in the middle, and is forced by the preſſure of the Water in the Ciſtern and

Pipes, through ſtrainers a little globulur, and full of Holes, and is divided into ſmall drops and makes the Vacuum above very quick. The Cocks which makes rhe Injection, are opend by the Chain of the Peſtin.

It may be objected alſo, that if part of the Injection ſhould be made above, and not the whole, that the ſteam below may ruſh in, and fill the Vacuum.

To which is anſwered, that one half of the Water is injected above, and being very Cold, continnes to condence the Steam as it falls down, and therefore the ſteam below can't riſe before the Injection from the bottom meets it, which comes very quick after and compleats the whole.

It may alſo be objected, that the Rope which cloaths the Peſtin, may rub on the edges of the Holes, and on the Strainers, and fret and fill the Holes in the Strainers.

To which it is anſwered, that the edges of the Holes are filed off, and made ſmooth, and ſome ſtrong Canvas ſewed on the Rope, oppoſite to the Holes, and the Strainers ſet ſo far out, as the Cloth can't rub on them, (which is conveniently done) which prevents any Inconvenience with reſpect to this objection.

It may alſo be objected. that if the Rod ſhould go down with Velocity, by the neglect of feeding the Mill, and ſo great a Weight on it as 2471 Pounds, that it might not be ſtopped ſuddenly by the Vacuum, before it would run ſo far as to ſtrike and damage the Engine.

To which it is anſwered, that the Velocity can't have any more Power to force the Peſtin higher, (to let the Rod further down) when the leaſt Vacuum is made above, than the Velocity of a Seale in weighing

Goods has, when going down with more Weight than is in the other Scale, which will ſtop and return the Inſtant a ſuperior Weight is put in the light Scale; and a Rod don't go down with ſo much Velocity as the heavy ſide of a Beam, for the Air has command of the Peſtin, and don't let it riſe faſter than the ſteam fills the Cylinder, which being large, and the ſteam coming through a narrow Paſſage takes ſome time; and the power of the Air will in the ſame manner turn the Peſtin, if the full load which it is allowed to work in lifting Water, being 4942 Pounds, but will not riſe with ſo much Velocity, and will return quicker when only 2471 is on it, which is all the Weight which will be on the Rod at any Time, which will be ballanced when the Mill is fed, ſo as to work regular.

If the opinion of any of the Engineers who attend the Engines in London, ſhould be aſked, with reſpect to the power of the Air on the Peſtin, when going up with uncommon Velocity, as above aſſerted, ſhould have any doubt of it; the Writer prays, that before they give their Opinion, that they will prove it, which may eaſily be done at any Time when the Water is out of the Pond, and the Working Barrel is empty, if they will pleaſe, when the Peſtin is down, to open the Steam Pipe, and let the Peſtin up with what Velocity the Weight will give it, half way or three-fourths, they will find that the Inſtant they cover the Steam Pipe with the Regulator, and prevents more Steam from going in, that the Peſtin will not move ſix inches higher, and that as much as it riſes higher, it will immediately return down, if the weight on the Rod is the full load the Peſtin works, or in proportion to Seven Pounds for every Square Inch of the Peſtin, which proves, that a very ſmall Vacuum made in the top of a Cylinder, will give the Air its Power on the Peſtin, and that the Steam don't ruſh into a Vacuum ſo made, when the ſteam Pipe is cloſed,

cloſed and don't let more into the Cylinder, which is always ſhut when the Peſtin is up, until it comes down.

But if any doubt ſhould remain with reſpect to the Injection above anſwering the deſign, the Writer has provided another Remedy, which is to fix a Wheel on the Shaft the Trunnel Head is on, ſuch as Fi. 7; over which, place a piece of crooked Timber, made to lie in the form of part of a Hoop (which ſome call a Break) ſuch as uſed in Wind Mills for grinding Corn, to ſtop the Arms when the Wind blows too ſtrong, or leſſen the Velocity, which is to lie over the Wheel very near it, and is to be ballanced ſo as to be eaſy pulled down on the Wheel. The friction of which will leſſen the Velocity more or leſs, or ſtop the motion of the Engine, as the Perſon who holds it down pleaſes. This may be done at any Time, if the Feeding ſhould be neglected, or ſtopping Work, and alſo at beginning Work, until the Rollers are filled. And a Rope or handle of Wood may hang cloſe by the Rollers, to be in readineſs to ſtop the Velocity at any time, which may be done in an Inſtant. And in caſe any Reader ſhould doubt of either or both the Remedies mentioned, the Writer has provided another, which muſt appear to every Reader that it will ſecure the Engine againſt any danger of Damage whatſoever, which may happen by neglect of feeding the Mill, or neglecting to ſtop the Velocity, by the ſaid Wheel, or of ſetting the Injection Cocks to open in proper time, which is by ſetting a Spring under the end of the Rod, on one end of a Beam of eight or ten foot long, the Beam to move on an Axis as the Laver does, with a Box on the other end, as Figures 26, 26, 26, 26. The Box to contain as much weight as on the Rod, or a little more or leſs as may be found to anſwer beſt, and the end of the Rod coming on the Spring firſt, (which is to be circular, and will let the Rod down eaſy on the end of the Beam, which Beam will give way alſo, as ſoon

as

as the whole Weight comes on it, which muſt prevent any ſhock to hurt any thing, if it ſhould ſtrike on the Spring every return of the Rod, eſpecially as there will be no weight on the Chain at ſuch time, but the Peſtin. The Beam need not be hung on an Iron Axis, but may lie on another piece of Timber; and in place of a Gudgeon, a piece of Wood half of a round of 6 Inches diameter, may be fixed with Spikes on the under Side of it, to lie in a hollow to be made for it, in the timber it lies on to move in. It is preſumed the end the Rod is to reſt on, may not move one Inch (if it ſhould at any time come ſo far down) if the other end is only 50 Pounds heavier. (N. B. The Springs are of Wood, and the Beams may lie under Ground.

But if the Cocks are ſet to open in the proper time, the Peſtin can never go ſo high as to let the Rod ſtrike on the Spring, and the Velocity of the Peſtin and Rod, which will be leſs when the Mill is full fed, and more in proportion as it is fed lighter, or neglected to be fed at all, can't be attended with any Inconvenience or Danger more, to the Engine or Sugar Mill, than it is to a Sugar Mill worked by a Wind Mill, when the Wind blows harder than uſual, which endangers the Wind Mill, but not the Sugar Mill, or Engine.

PLAN B is a Ground Plan, or horizontal View of the Machine, and a Sugar Mill, ſuch as are worked by Windmills, in grinding or compreſſing canes to wit.

T is the ſame working Rod T, in Plan A, and U U the half Wheels U U in the ſaid Plan. Figures 1, 1, two Wheels on the ſame Shafts. 2, a Wheel to be moved by them alternately, to be ſet either above or below, as may be found moſt convenient; and it moves them, and the half Wheels at the ſame time alternately, as they are diſcharged by the Cogs in the Rod, and brings them in place again, which keeps the whole in a continual Motion. 3, A Trunnel Head, which being on the ſame Shaft with 2, moves

4, which is a Wheel ſuch as in Mills, which are worked by Wind Mills, which moves the middle Roller 5; which middle Roller moves the ſide Rollers 6, 6; between which Rollers the Canes are compreſſed, commonly called Ground. 7, A Cog Wheel, on which a Mill may be fixed, to grind Corn for the Negroes, or any other kind of Mill, and grind Canes at the ſame time. This Wheel may alſo ſupply the place of a Wheel mentioned in Plan A, to lay a Hoop or Break on, to ſtop the Velocity of the Engine, if at any time there ſhould be occaſion for it.

It is to be obſerved, that two of the Cogs 6, 6, in Plan A, are to be ſloped in one end as in the Plan, and the mortaces made eaſy, to let them ſink in, to let the Cogs 8, 8, in the half Wheels paſs them alternately; and a ſpring is to be fixed under one end, or on one ſide of each of the Cogs 6, 6, to ſend them quickly back, to continue the motion of the Cogs 8, 8, in the Wheel on their return alternately, which Cogs 6, 6, are to be made in the form of A. The Mortaces for them are to be made about a quarter of an Inch wider at top than bottom, to let the ſloped end fall ſo much back, as to bring the notch on the ſame end of the Cog, out of a Bed which is to be made for it to fall into, on the return of the Rod, to keep the Cogs from ſinking again into the Mortaces, by the friction. And the long Mortaces in the Cog A, is for a ſmall Iron Pin to lie in, to prevent the Cog from being carried farther out of the Mortace than it ought, by the ſpring or friction of the Cogs, when the Rod returns.

It is to be obſerved alſo, that the bends of the half Wheels, and the working Rod, each are to be ſo broad, as to hold three Cogs in the Brength, as the ſloped Cogs 6, 6, and 10, 10, on the Rod, and 9, 9, on the half Wheels, are not to be ſet in a Line with the reſt of the Cogs which make up the half Circle; and the Cogs 9, 9, on the half Wheels, and 10, 10, on the Rod, (being one more on each than the half Circle) is to keep the Wheels in motion until the Cogs 8, 8, paſſes the ſloped Cogs 6, 6, that the ſloped Cogs may be ready to move them on the return of the Rod (as before.)

For Example, ſuppoſe the rod in the Plan going up, when Cog 8 on the half Wheel, and 11 on the Rod (on the left ſide) comes to a level with the Shaſt, the Rod will be near the end of the ſtroke up, and the rod continuing the motion, perhaps 2, 3, or 4 Inches farther, Cog 10 on the rod being behind cog 9 on the half wheel on the ſaid ſide, keeps the Wheel in motion; and Wheel 1 being on the ſame ſhaft with the ſaid half Wheel, moves Wheel 2, which moves the other Wheel 1 on the right, which keeps the half Wheel on the ſaid ſide in motion, it being on the ſame ſhaft with it; and Cog 12 on the ſaid half Wheel on the right, at the ſame time meets the ſloped Cog 6 on the rod on the ſaid ſide; and preſſing againſt it, the notch in Cog 6 is puſhed out of the Bed, and lets the Cog ſink into the Mortace, but is quickly returned by the Spring; and on the return of the rod as ſoon as the ſloped Cog touches Cog 12, the notch is puſhed into the Bed again, which prevents it from ſinking into the Mortace again by the Friction. And ſhould the rod go 4 or 5 Inches farther, the whole will be kept in motion by the Cogs 10 and 9, on the left ſide. And Cogs 6, 8, 9, and 10, on the right ſide, does the ſame alternately, which keeps the whole in a continual motion. And if the rod ſhould at any time go 12 Inches farther than the ſtroke, it won't be attended with any Inconvenience, except the loſs of ſo much time by the Mill ſtanding until it returns. And if the Engine ſhould at any time (by the Fire being neglected) not make a full ſtroke, all the Inconvenience attending it will be, that the Rollers will turn back, in proportion to the length of what the Rod has to return, which it muſt do at any time the Mill happens to be over-fed, over-fed, and ſtop the Engine. But the Power being always the ſame, and more than is neceſſary, it may be fed regular, and won't be ſubject to be ſtoped often by over-feeding, as Wind Mills or Cattle Mills are, (as before obſerved.)

The half Wheels are four foot diameter, which being 12 foot circumference, and the ſtroke of the rod being 6 foot, moves one half Wheel, half the circle going up, and moves the other, the other half circle coming down, which moves Wheel 2 once: It is to be obſerved, that the motion of Engines is partly in proportion to the length of the ſtroke, which for common is from 6 to 8 foot. But the Writer thinks 6 moſt ſuitable to the preſent Intention, on account of the quickneſs of the motion, and the Power being ſufficient alſo, the motion of a rod which ſtrikes ſix foot, uſually makes from 13 to 15 ſtrokes (that is up and down, which is called one ſtroke) in a Minute, in proportion to the conſtancy of the Fire, and the weight of Water the Peſtin lifts. But it is preſumed, that the Fire will be more conſtant, and the Peſtin ſeldom ſo heavy loaded in working Sugar Mills, as in lifting Water, and therefore muſt make more ſtrokes. It is ſuppoſed it will make 15 or upwards in a Minute on an Average. And as the Wheel on the middle Rollers is 4 foot diameter, being the ſame as the half Wheels and other Wheels, and the Trunnel Head only 16 Inches diameter, which is only one-third, if the Engines makes 15 ſtrokes in a Minute, the Trunnel Head muſt move Wheel 4 one-third as often, which is five times in the ſaid time. And the Power being 2471 Pounds on the half Wheels, gives the ſame Power to Wheel 2. And the Trunnel Head being on the ſame ſhaft, and being only one-third of the diameter, muſt work with three times as much Power on Wheel 4, which is 7413, which Wheel 4 being four foot diameter alſo; and the middle Roller only two foot, works with double that force on it, which is 14826 Pounds on the outſide of the middle roller, to bring it about, except what it may be leſſened by the friction of the Cogs.

If any Inconvenience ſhould be found by the Trunnel Head being ſo ſmall, the Wheels 1, 1, ~~and 2~~, may be made leſs, and the Trunnel Head larger in proportion, ſo as to make little alteration in the Power, or Motion. But the Writer choſe the Dimentions in the Plan, on account of the Motion and Power being eaſy underſtood by ſome Readers.

PLAN C, repreſents another Method of the firſt moving wheels, to be worked by chains, in place of Cogs, which may be convenient in ſome kinds of Mills, but not ſo convenient for Sugar Mills, (to wit.)

Figures 1, is two Wheels with Teeth, all round the outſide, U U two Wheels, one on the outſide of each of them, which is moved backward and forward half the Circle, which are to be ſupported by ſeperate Arms, or ſpokes in each ſide of the inner Wheels, to be ſet in Boxes, and turn eaſy on the ſhafts of the inner Wheels. III, III, two Chains, to be faſtened to the outer Wheels, by an Iron Pin. IV, IV, two Hooks of Iron, fitted to catch on the Teeth, to bring the inner Wheels about alternately, on the return of the Rod; and is to be faſtened to the outer Wheel and Chain by the ſame Pin. V, V, two Springs, to keep the Hooks cloſe to the Teeth, and cauſe them to fall in quick, to take hold on the return of the Rod. VI, VI, two ſmall Chains, which moves on the two Pullies VII, VII, to bring the outer Wheels back. ~~VIII, VIII, two ſmall Pullies, the uſe~~ of which appears in the Plan.

PLAN D a horizontal or ground Plan of a Boiling Houſe; ſuch as work with ten Coppers, and the Method of ſetting the Coppers, to be convenient for the Flame, from one of the Clarifiers, to ſupply the

Boiler of the Fire Engine. Alſo the Method of conveying the warm Water from the Engine to the Cooler or Coolers, and from thence to the Engine Well, without any Labour, (to wit.)

Figure 1 the Boiler of the Engine, the dimenſions of which is deſcribed in Plan A. 2, One of the largeſt Coppers, (called a Clarifier) which is five foot wide at top, 4 at bottom, and 3 foot deep. 3, The Fire Place, where the Fuel is put in to ſupply it. 4, A Flue or Paſſage for the Flame, to paſs from the Clarifier to the Boiler. 5, A Plate of Iron or Pot Metal, fitted to the wideneſs of the Flue, which ſlides up and down in a Frame, to let more or leſs Flame to the Boiler, or to ſtop the whole, by letting it all down. 6, A Flue to receive part of the Flame from the Clarifier, when it is too ſtrong for the Boiler, or the whole of it when there is not occaſion for the Engine to work, which is done by raiſing or lowering the Dampers. 7, Another Damper ſet in the ſaid Flue 6, for that Purpoſe. 8, A Fire Place, to put in ſome Fuel under the Boiler, to aſſiſt the Flame from the Clarifier, when the Fire is leſſened, in the time the Liquor is Clarifying, or to Boil ſeperate as occaſion may require. 9, A Flue, which carries the Flame round the Boiler, which enters at the Paſſage 10, where it divides; and part of it goes round one ſide, and part round the other, and meets at 11, which is a Flue, which carries it to the Chimney 12. 13, One of the ſmalleſt Coppers called a Teach, which is about 32 Inches wide at top, 27 at bottom, and 24 deep, and contains from 60 to 70 Gallons. 15, Another, about 41 Inches at top, 33 at bottom, and 27 deep. 16, Another, about 47 Inches at top, 38 at bottom, and 30 deep. 17, Another, about 54 Inches at top, 43 at bottom, and 33 deep; which Coppers are all boiled by the ſmall quantity of Fuel, which boils the Teach. 14, The Fire Place, where the Fuel is put in under the ſaid Teach. 18, 18, 18, Flues, through which the Flame paſſes from one Copper to another. 19, 19, A Flue, which conveys the Flame from the ſaid Coppers to the Chimney 12. 20, A Cooler, into which the Sugar (when it is made) is convey'd from the Teach, by the Spout 21, which concludes the Deſcription of one half of a Boiling Houſe, by which it appears, that the Method propoſed of ſetting the Coppers, is as convenient as the uſual Method; and that the draught from the Clarifier and Teach, is improved by it. The right hand end of the Plan, ſhews the Method the Boilers are uſually ſet. 22, 22, 22, three Sills, on which the Frame is to ſtand, to carry the Cylinder and Laver. 23, 23, 23, The Mortaces in the ſaid Sills, and the like are to be in the other end of each, for the ſix poſts to ſtand in; four of which poſts is to bear two Beams, to be let into the poſts, in long Mortaces, by which the Beams may be raiſed or lowered when the Frame is up, as the ſituation of the Boiler may require, which Beams are to bear two other Beams, on which the Cylinder is to be ſet. 24, 24, The Laver A A in Plan A, which is bore by a Beam to be mortaced into two of the Poſts, which is to ſtand on Sill C. The Beams will only be ſeven or eight foot each, but if it ſhould be thought neceſſary, another poſt may be ſet on the Sill, between the other two to ſtrengthen the Beam.

The Sills are to be ſet each on a Foundation of Stone or Brick, about 12 or 15 Inches higher than the wideſt part of the Boiler, to be above the Flues, and the length of the poſts and framing them, may thereby be calculated very near, 25, The Engine Well. A is a Pump in it, to be worked by the Laver 24, 24. 26, The Hot Well o in Plan A. 27, 27, A Pipe which conveys the Water from it to the Cooler 32. 33, A Pipe, which ſtands in the ſaid Cooler, through which the Water (being cooled by the Ground as it goes down) comes up from the bottom, as the warm Water comes in on the ſurface raiſes it, and is convey'd to the Engine Well 25, by the Pipe 45. But if another Cooler ſhould be neceſſary, the Pipe 45 may be ſtopped, and it may be convey'd into a ſecond Cooler, (as 34) and will cool as it goes down in it alſo, and the Water will riſe in it from the bottom, through Pipe 35; and be convey'd to the Engine Well by Pipe 36. But if proper ſhades of Plank or Boards are made, to keep the rays of the ſun from one Cooler, and the Engine Well; the Writer thinks there can't be any doubt, that they will cool the Water ſufficiently, as it will be lifted from the bottom of the Engine Well, it will cool as it goes down in it alſo, (if not ſufficiently cooled before) and will have one Night at leaſt, if not two Days and Nights, to cool; for it will always be more than 24 Hours in coming about through the cold Ground, as the two Wells will contain more Water, than will be warmed in the time the Engine and Stills will work each Day. For it is preſumed there won't be occaſion to work the Engine more than eight or ten Hours in the Day, to ſupply ten Coppers; and the Water is not made much hotter, than the ſun will make Water in a ſhallow Pond in a hot Day, in the Weſt-Indies.

N. B. The Writer intends, in a ſhort Time, to publiſh a deſcription of the uſes of his Invention, in ſeveral other kinds of Mills; particularly in working Saw Mills, Furnace and Forge Bellows; and Forge and Tilt Hammers; which he apprehends will be of conſiderable uſe in North-America, as Fuel may be had there at very ſmall Expence; and they may be ſet in the moſt convenient Parts, for the beſt Timber for Sawing, and moſt convenient for Navigation to Ship it, (and being Portable may be removed at ſmall Expence) And in the moſt convenient Parts for Iron Mines, which lie in many Parts, where Falls of Water can't be had to turn Wheels, within a moderate diſtance, &c. And will be of conſiderable uſe in England alſo, (where Fuel can be had at a moderate Expence, and falls of Water can't be had convenient) in working all kinds of Mills, uſually worked by Wind, Water, or Horſes. And the Writer thinks that notwithſtanding the high Price of Fuel in London, they will be more profitable and convenient in ſeveral Manufactures than Horſe Mills, as they may be made to Work ſeveral Mills at the ſame time, or ſeperately. The Engines may be much leſs to work moſt Mills, than is propoſed for Sugar Mills, according to the uſes for which they may be intended. And the coſt of the Engine and Machine, will be in Proportion to the Force required.

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Oct. 1861 7/6

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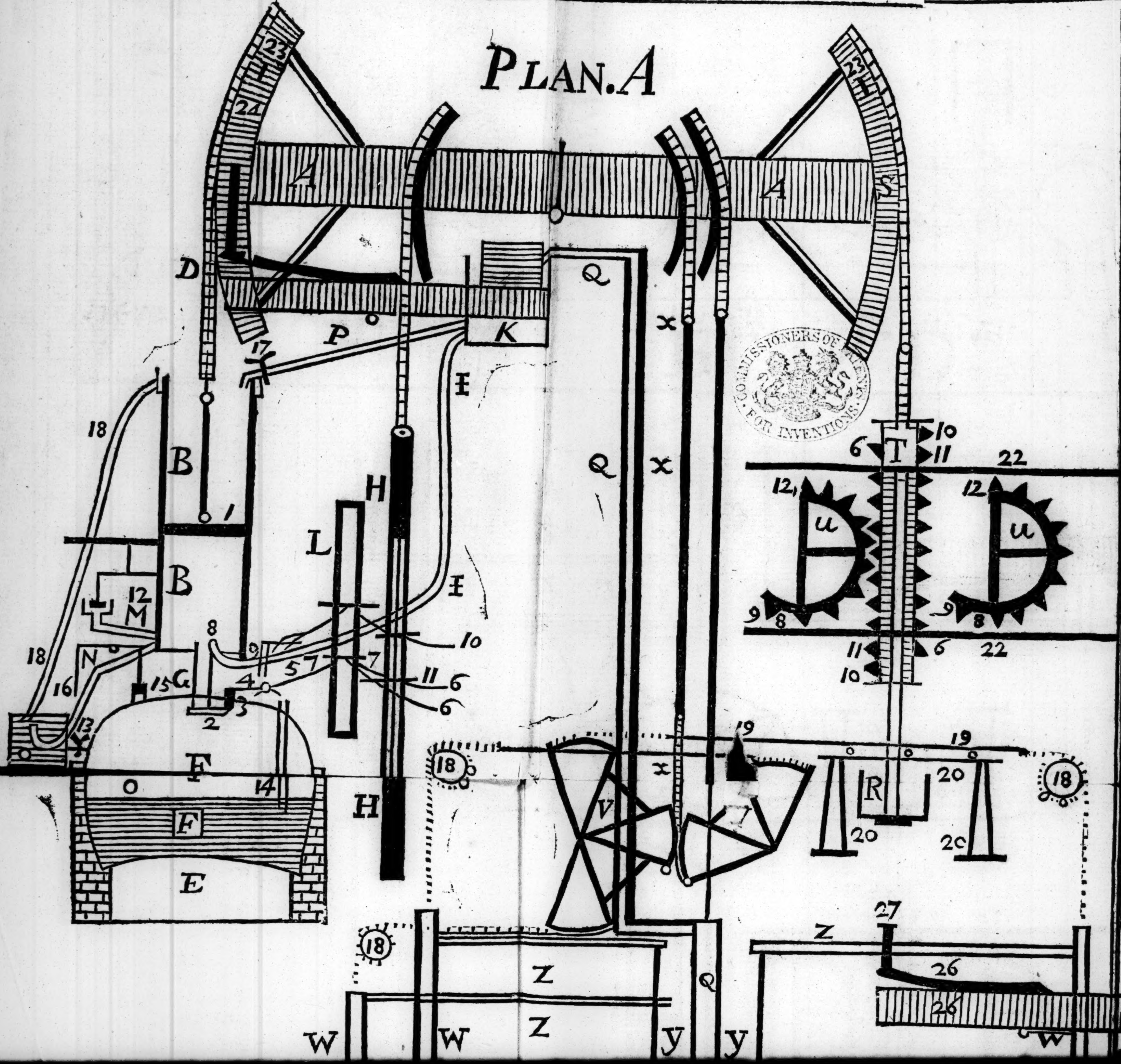
PLAN. A



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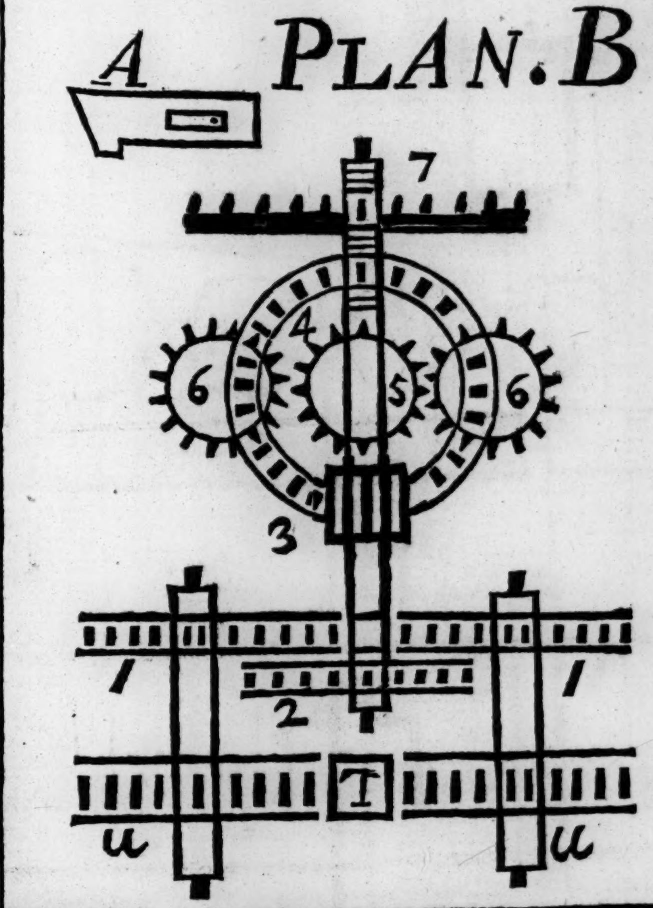
PLAN. B



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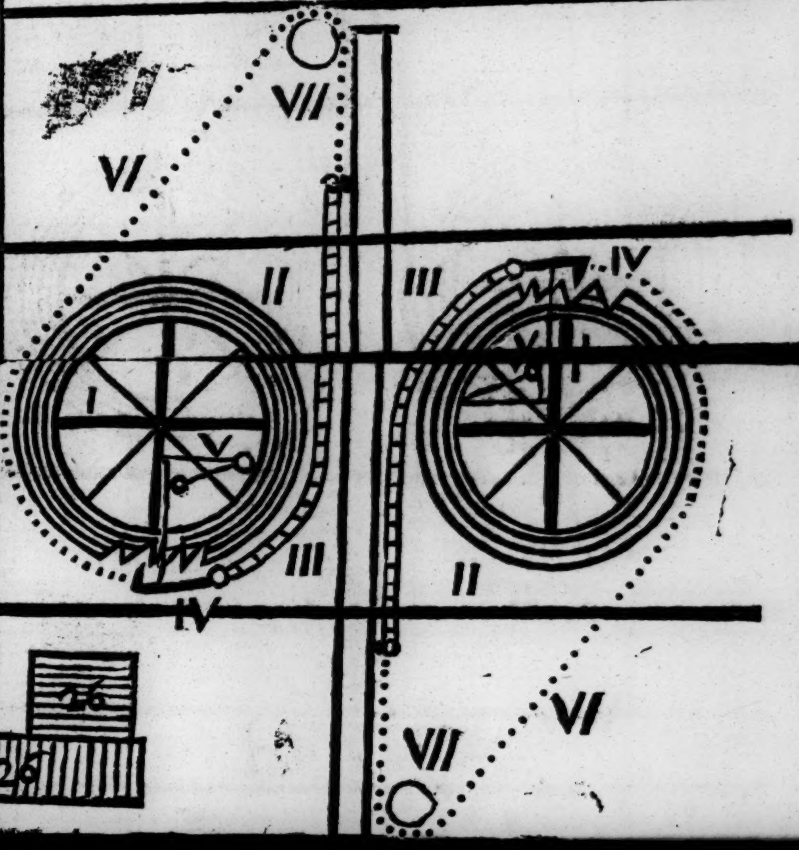

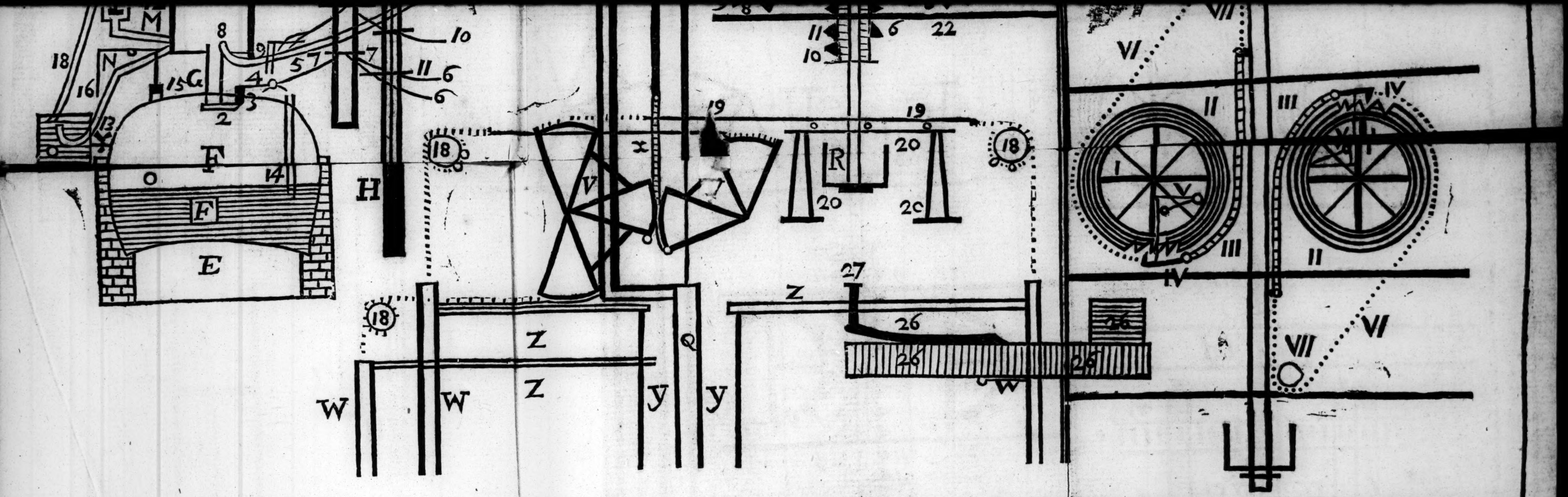
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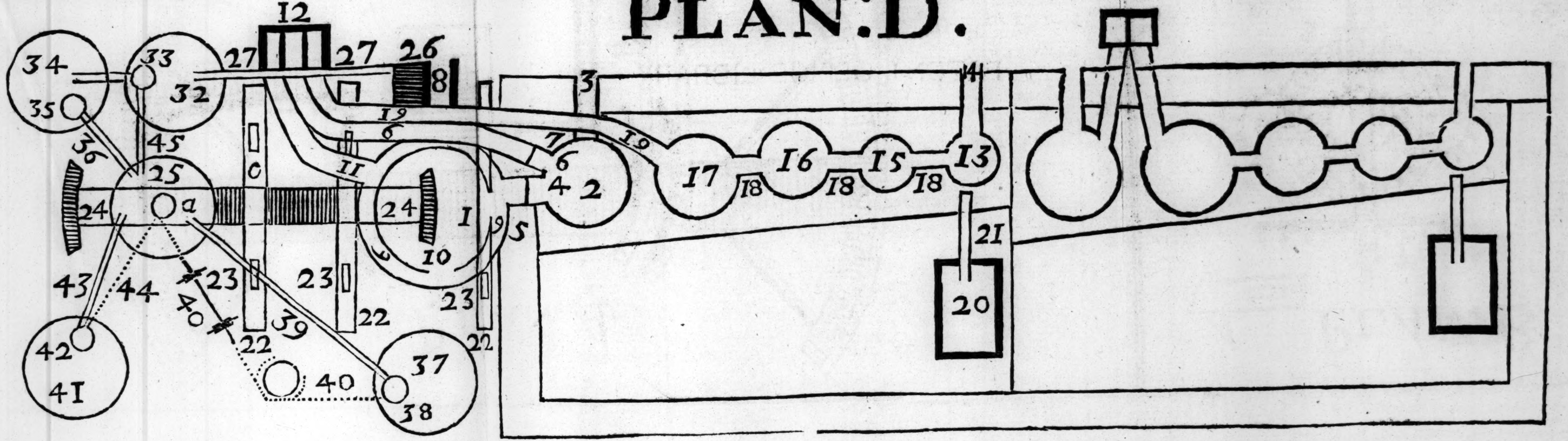
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AN APPENDIX

TO A

Deſcription of a Machine or Invention to grind Sugar Canes, by the Power of a Fire-Engine, &c. by John Stewart.

COMMISSIONERS OF PATENTS FOR INVENTIONS

Which ſhews, in a few Pages, the Utility of it, and ſeveral Objections which have been made to it are explained and anſwered. Alſo a calculation of the Power of Cattle in grinding Sugar Canes, and the Power of Fire Engines in the ſame; with references to the ſaid Deſcription, and Plans annexed thereto.

SINCE the ſaid deſcription was printed, the writer delivered copies thereof to ſeveral gentlemen, who are proprietors of ſugar eſtates; and therefore moſt likely to judge of the probability of his invention anſwering the deſign; and alſo to the moſt ſkilful engineers of fire engines, and in making machines and mills; and requeſted of each of them, that they would make remarks on every thing, which might appear to them to be ſubject to objection; and the writer having collected every objection which he can hear of, (although the greater part of them are ſtated, and anſwered in the ſaid deſcription) adds this in anſwer to them.

But firſt, It may be proper to obſerve, that the greater part of the ſaid gentlemen, and every engineer, (whom the writer has talked with) acknowledge, that they are ſatisfied, that the machine is ſimple, and that the alternate motion of the fire engine, may by the machine work the circular motion of wheels, and act with the power on the rollers of a ſugar mill, as mentioned in the deſcription. But the writer was told by ſeveral gentlemen, that there has been ſo many inventions tried in the Weſt-Indies, to leſſen the expence of grinding canes, (which coſt conſiderable ſums of money, and was of no uſe) that it is doubted it will diſcourage them and other gentlemen, from being at the expence of carrying the moſt plauſible ſcheme into execution. Wherefore the writer begs leave to obſerve, that he underſtands, that the deſign of all thoſe inventions was only to grind canes with fewer cattle; which was endeavoured, by multiplying wheels to gain power; the attempt of which, where a certain ſpeed, as well as force is required, and the moving power limited (as it is to the ſtrength of the cattle in cattle mills) is exactly parallel, with the many attempts which have been made to find out a perpetual motion, by making one weight continually over-ballance another of equal weight, without any purchaſe. Wherefore if ſome gentlemen have been brought into expences, by thoſe miſled, by miſtaken imaginations, who have been purſuing impoſſibilities, are diſappointed of their expectations, the writer preſumes, that it will not be conſidered as a reaſon to them or other gentlemen, to determine them not to encourage his invention, which is plainly ſeen to be ſimple, and is underſtood by moſt gentlemen, and every engineer, and millwright, who has ſeen the plan of it, and that there can't be any doubt of the force; fire engines being proved to be the greateſt power on earth, yet is moſt under command, and the force may be apply'd in any degree, and is more certain and conſtant than any yet known, more ſo than water mills, which is the beſt yet practiced, (where water is conſtant) but they are alſo ſubject to delay and diſappointment, by the dams frequently breaking, which takes much time and expence to repair them, and many of them have not conſtant water; whereas a mill worked by a fire engine, is not ſubject to any diſappointment or delay whatſoever,

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but is attended with many profitable conveniencies beſide; particularly, that it may be ſet in the moſt convenient part of a plantation, for convenience of water, and carriage of the canes, and thereby muſt ſave much labour, and is not ſubject to any accident, as wind mills, and cattle which work cattle mills are; and therefore require little repairs, and may work conſtant night and day, and being of ſufficient force, and not ſubject to any accident, to occaſion delay; the canes may always be ground when in the beſt order for it, which by the uncertainty of wind, and want of force of cattle, frequently ſtand too long, and when the crop is large, planters are obliged to take the opportunity of the wind, and grind canes before they are full ripe; either of which is attended with conſiderable loſs, in the quantity as well as quality of the ſugars, and frequently a great deal of canes for want of force to grind them in time, take a ſecond ſpring or growth, and are entirely loſt; and there is conſiderable loſs of ſpirits by evaporation coming hot from the ſtills, by the neglect of negroes not keeping the worm tubs cool, and they alſo contract a bad ſmell and taſte from the worms when hot, which may be prevented by the fire engine, which will raiſe water to keep a continual ſtream running into the worm tubs, without any expence of labour; and the engine will alſo force water through pipes, to the boiling houſe, ſhould it be half a mile diſtant, and alſo raiſe it to any high ground in a plantation 100 foot high, from whence it may be conveyed in ſpouts to every cane piece, where water can be had; and the fire engine may be ſet up to work in 12 or 15 days after it arrives at the plantation, whereas in new plantations it uſually takes two or three years to fix a wind mill and cattle mill, which employs the bulk of the negroes, who might be employed in clearing ground, and planting canes, which advantages may be had without any expence of fuel, beſide the ſaving in the firſt expence of a wind mill, and a cattle mill, and cattle to work it, from £1200, to £1500, and the annual ſaving of £632, 16s. The particulars of which may be ſeen in page 14, and the ſeveral other advantages above-mentioned appears more fully in the ſaid deſcription annexed. But as it may not be convenient for ſome gentlemen to ſpare time to read the ſaid deſcription, the writer thinks proper to give this ſhort ſketch of it in this appendix.

1ſt, It is objected by ſome gentlemen, that they are doubtful that the flame from the clarifier may not work the engine properly, but they admit, that the fuel is ſo hot, that the ſmall quantity of it uſed in boiling the ſmalleſt copper, (called a teach of only 60 gallons) boils three more, which for common contains 500; in all 560 gallons; therefore it can't admit of any doubt, that the flame from a clarifier of 250 or 300 gallons, (which conſumes four or five times as much fuel) will be much more than ſufficient for the boiler of the fire engine, in which will be only two foot depth of water, and contains only 450 gallons, and the flame when too great, may be leſſened in an inſtant, in any degree, and increaſed in the like time by dampers, which are deſcribed in plan D.

2d, It is objected, that in moſt eſtates water is ſo ſcarce, that the wells don't produce ſo much as anſwer the uſes of the boiling houſes, and negroes, and cattle to drink; and ſome planters are obliged to ſend their cattle a mile or two to water, and to make ponds or reſervoirs to ſave rain water for the worm tubs, and to cool it in ponds, and uſe the ſame always; and therefore none could be ſpared for the uſe of a fire engine. To which it is anſwered, that there is no viſible waſte of water in a fire engine, except by a ſmall quantity of ſteam which comes from two pipes, which can't waſte ten gallons in a day; for what ſteam is raiſed by the boiling the water, is condenſed in the cylinder to make the vacuum, by the injection of the cold water; and may be cooled and uſed again, as it is done for cooling the worm tubs; and as many reſervoirs may be made to ſave rain water for the uſe of the engine, as may be neceſſary. It is preſumed, that one or two of twelve feet diameter each, and twelve feet deep, would contain more than a fire engine would waſte in three months, ſhould a drought happen to continue ſo long; in one of which reſervoirs is only fifty cubic yards, (which is dug in London for ſix-pence per yard) and if it ſhould require ten ſuch reſervoirs, it can't be a ſufficient objection. This objection is ſtated in page 23, and in a deſcription of plan D, in page 42, which alſo ſhews the method of cooling the water, and how it comes from the coolers and reſervoirs, to the engine well, and is raiſed by the engine into a ciſtern, to ſupply the injection, worm tubs, and other uſes, without any expence of labour.

3d, It is alledged by ſome gentlemen, that the power of the fire engine propoſed, is not ſo great as the power of a cattle mill. The length of the beams the cattle draw by, being a great purchaſe, and therefore can't do ſo much work as a wind mill and a cattle mill uſually do. In order to come at ſome ſort of meaſure, or computation of the power cattle have in works of this kind, and thereby make an eſtimate of the power the engine propoſed may have in grinding canes. The writer apply'd to Mr. John Maſſey, chief engineer of the fire engines, and water works of Shadwell; who is alſo principal director of the fire engine, and water works, worked by the ſaid engine at London-Bridge. A man of ingenuity and knowledge in the theory, as well as long experience in fire engines, and the power of machines worked by horſes, in drawing coals out of mines; and the writer refers to a copy of an eſtimate annexed, certified by him, of the power horſes have in drawing coals out of mines, which is parallel (or near it) with the draught of cattle in a ſugar mill, and the principles and power of a fire engine, &c. By which it appears, that the force of horſes from 14 to 15 hands high, fed on oats, beans, bran and hay, is no more than 112 pounds at a medium, which may appear fabulous at firſt ſight, as a horſe can draw 1000 pounds in a waggon; but if it is conſidered that they move ſlow when heavy loaded, and can apply their weight as well as their ſtrength, and that the weight they draw lies on large wheels; and that horſes in a gin are drove at a trot, (as mules are in a ſugar mill) and lift their feet quick, and therefore can't apply much of their ſtrength to the draught, the reaſon will appear; wherefore if the ſuperior ſtrength, height, and weight of ſuch horſes, with the difference of feeding, and horſes drawing more kindly together, and in a cool climate, is compared with the ſtrength, &c. of the common run of mules. It is preſumed, that one horſe in a coal gin, draws, at leaſt, with as much power as two mules in a ſugar mill; and ſuppoſe the rollers of a cattle mill to be two feet diameter, as one pound, or one hundred on the out-ſide of the middle roller, (which being 12 inches from the centre) will give the ſame power to bring it about, the ſame weight moved one foot from the roller on a beam fixed in the roller, will give two pound, or two hundred, and ſo on to any length; ſo that 100, at 15 feet from the centre of the roller, which is ſuppoſed to be the uſual length of beams, by which mules draw in a ſugar mill, will give a power of 1500, on the out-ſide of the roller to bring it about; and as the power a mule gives in this work, is computed to half the power of a horſe which is 56 pounds, each mule will give a power of 840 pounds; and if a mill is worked with ſix mules, they will give a power of 5040; and as a mill worked by a fire engine, with a cylinder of 30 inches diameter, will give a power of 14800 on the out-ſide of the roller, to bring it about, which is near three times as much as the power mules give, and will move the rollers round five times in a minute, and work conſtant; and it is ſuppoſed, that mules don't move the rollers more than twice and a half in a minute, the day throughout, after allowing for time loſs'd, in changing and ſtops, it muſt appear, that a mill worked by a fire engine, will grind more than five mills worked with ſix mules each; excluſive of what the power may be leſſened by the friction of the cogs, &c. which is computed to be about one-eighth part, is ſuppoſed more than a mill could be conveniently fed with, unleſs rollers were made longer for the purpoſe. But the power may be leſs, by uſing a ſmaller cylinder, or increaſed by uſing a larger; a cylinder of 36 inches diameter, would give a power of 21384 pounds.

4th, It is objected by ſome engineers, who are not acquainted with the nature of feeding a mill with ſugar canes, that if the feeding the mill ſhould at any time be neglected, the weight on the rod (having no ballance but the peſtin) may come down with velocity, and may damage the engine. To which it is anſwered, that if the feeding a wind mill is neglected, it will run with ſo great velocity, as to occaſion conſiderable damage to the mill, But this ſeldom happens, except when canes are not brought in ſo faſt as the mill grinds them, and the negroes who feed the mill don't obſerve it in time, and ſtop it before the canes at the mill are near done; in which caſe, they run out of the mill in great hurry to ſtop it, which is not ſoon done, for at moſt mills, it uſually takes five or ſix negroes to bring the tail tree about, to turn the veins out of the wind, which is the uſual way of ſtopping them; but negroes are corrected for ſuch neglects, which obliges their attention, and if the wind is ſteady, and does not riſe and fall often ſuddenly, they can feed a mill ſo near the force of the wind, that very little alteration will be ſeen in the motion, in a whole day; and the force of a mill worked by a fire engine, being always the ſame, may be fed much more regular than a wind mill, and can be ſtopped in an inſtant, and therefore may not be ſuffered to run with much velocity once in a years time. But the writer has made ſuch proviſion, to prevent any damage which may happen by ſuch neglect, that if it ſhould happen fifty times every day, it can't damage the engine, which appears in page 31.

5th, It is objected by ſome engineers, that if the rod ſhould paſs the uſual ſtroke much, that the ſloped cog 6 on the rod, may on the return, come with a ſtroke on cog 12 on the wheel, and endanger the breaking them. To which it is anſwered, that the engine will be regulated ſo, as the rod can't paſs the ſtroke more than four or five inches, and it is ſuppoſed, that it won't return with ſo much velocity, as to give ſuch ſtroke as to break the cogs; but if any inconvenience ſhould be found by this, it is eaſy remedied, by placing ſuch wheels, as are repreſented in plan C, in place of the wheels with cogs, which are to be worked by chains and hooks, which will not be liable to ſuch objection, as the hook on one chain will be in hold, as ſoon as the hook on the other ſlacks.

6th, It is objected by ſome gentlemen, that it may be difficult to get men of underſtanding in fire engines, to go to the Weſt-Indies to work them, and in caſe of one dying, the engine could not be worked.

This objection is ſtated and fully anſwered in page 25, and for a proof of what is there aſſerted of the ſimplicity of a fire engine, and being ſoon underſtood by any perſon of tolerable capacity, the writer refers to the before-mentioned certificate of Mr. John Maſſey, annexed.

* * *

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Copy of a Certificate,

FROM

Mr. *JOHN MASSEY*,

Mentioned in the Appendix.

I JOHN MASSEY, engineer of the water-works, and fire engines of Shadwell, in London; do certify, that I have read a pamphlet, intitled, "A de-"ſcription of a machine or invention, to work mills, "by the power of a fire engine; but particularly "uſeful and profitable in grinding ſugar canes, &c. "by the King's Patent to John Stewart." And I am fully ſatisfied, that the principles and power of a fire engine therein deſcribed, is juſtly and fairly repreſented; and that in a courſe of twenty years, or upwards, in which I was employed in the management of coal mines, and fire engines, I have not known any accident or damage happen to any of them, which could not be repaired, and the engine ſet to work in a few hours, except when the boilers were much wore, and a hole or holes broke out, that the engine might ſtop for twenty-four hours, to cool the boiler, and mend the holes; or when a boiler was wore out, and replaced with a new boiler. And I do farther certify, that a fire engine is not difficult or uncertain, to be kept in order to work, by any perſon who has been inſtructed in it; and that I think I could inſtruct any perſon of a tolerable capacity, in leſs than a months time, ſo as to be capable of working, and keeping one in order; and I do not know any difficult or expenſive repairs, which a fire engine requires, except the boiler as before, when wore out; other repairs being chiefly to take out a link of a chain when much wore, and to put in another, or mend a hole in a boiler, which is done in the manner deſcribed in the ſaid pamphlet; and in my opinion, the repairs which a new engine would require, for the firſt four or five years, would not amount to three pounds yearly, including leathering the pump, oil, &c. And I do farther certify, that the weight of coals, which three able horſes, from fourteen to fifteen hands high, uſually draws out of a pit in a horſe gin, is from five to ſeven hundred, but ſmaller horſes leſs in proportion to their ſtrength; and that two ſhifts in a day, of three hours each, is ſo hard labour for them, that it uſually kills them in leſs than two years; and to enable them to perform the ſaid work, they are fed thrice a day with beans, oats, and bran, and has as much hay as they can eat, but not allowed any graſs, on account that it purges and weakens them ſo much, that they could not do near ſo much work. They were drove at a trot, except while the coal baſkets were emptying above, and the baſkets changing below; at which time they turned and went round the reverſe courſe. The beams they draw by are uſually twice as long as the half diameter of the wheels of the gin, which move the ropes, which lightens the weight to the horſes one half; ſo that the force which each horſe draws at the end of the beam, is only 112 pounds at a medium. Dated this 7th of April, 1767.

John Maſſey.

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